

SOLAR OBSERVATIONS.

SOLAR AND SKY RADIATION MEASUREMENTS DURING JANUARY, 1922.

By HERBERT H. KIMBALL, Meteorologist.

For a description of instruments and exposures, and an account of the method of obtaining and reducing the measurements, the reader is referred to this REVIEW for April, 1920, 48:225.

From Table 1 it is seen that direct solar radiation intensities averaged slightly above the normal for January at Washington, D. C., and Santa Fe, N. Mex., were close to normal at Madison, Wis., and decidedly below normal at Lincoln, Nebr.

Table 2 shows that the total solar and sky radiation received on a horizontal surface was generally above normal at Madison; at Washington there was a decided deficiency during the week beginning with January 15.

Skylight polarization measurements made on four days at Washington give a mean of 57 per cent, with a maximum of 62 per cent on the 25th. These are slightly below the average January Washington values. At Madison no measurements were obtained, as the ground was covered with snow during the entire month.

TABLE 1.—Solar radiation intensities during January, 1922.

Washington, D. C.¹

[Grand calories per minute per square centimeter of normal surface.]

Sun's zenith distance.												
Date.	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon.	
	75th meridian time.	Air mass.										Local mean solar time.
		A. M.					P. M.					
		e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	
Jan. 7.	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.	
9.	2.49						1.12	0.98	0.83		1.84	
14.	3.81			1.13			1.22	1.04			4.57	
25.	2.28	0.70	0.82	0.97	1.22		1.23	1.11	0.99	0.87	2.06	
26.	0.96	0.93	1.05	1.19	1.34	1.51	1.29				1.12	
30.	0.86	0.77	0.88	1.05	1.26	1.52	1.24	1.12			1.12	
Means.	1.38				1.31		1.20	1.00	0.99	0.95	4.75	
Departures.		0.80	0.92	1.08	1.28		1.22	1.05	0.94	(0.91)		
		+0.63	+0.64	+0.66	+0.65		-0.01	+0.01	+0.06	+0.11		

Madison, Wis.

Jan. 9.....	2.62	0.90	0.99	1.16	1.32	1.44	1.14	0.99	0.83	0.71	3.15
11.....	1.78	1.08	1.16	1.32	1.44	1.51	1.32	1.16	1.04	0.91	1.78
12.....	0.79	0.88	1.04	1.21	1.41	1.51	1.21	1.04	0.91	0.79	1.37
16.....	1.32	0.91	1.03	1.21	1.41	1.51	1.21	1.04	0.91	0.79	1.68
19.....	1.07	0.91	1.03	1.21	1.41	1.51	1.21	1.04	0.91	0.79	0.71
20.....	1.19	0.91	1.03	1.21	1.41	1.51	1.21	1.04	0.91	0.79	1.52
21.....	1.78	1.08	1.16	1.32	1.44	1.51	1.32	1.16	1.04	0.91	2.62
24.....	0.46	0.91	1.03	1.21	1.41	1.51	1.21	1.04	0.91	0.79	0.28
Means.....	0.98	1.08	1.22	1.44	1.65	1.72	1.22	1.08	0.94	0.81	
Departures.....		+0.03	-0.01	-0.03	+0.07		-0.02	-0.04			

WEATHER OF NORTH AMERICA AND ADJACENT OCEANS.

NORTH ATLANTIC OCEAN.

By F. A. YOUNG.

The average pressure for the month was slightly below the normal at land stations on the east coast of Newfoundland and in the south of England and Ireland, while the departures were small on the Atlantic and Gulf coasts of the United States, as well as in the Bermudas. The monthly average at Horta, Azores, was somewhat above the average, the unusually high barometric readings that prevailed from the 1st to the 21st being partially overcome by the period of low pressure during the last decade of the month.

Comparatively few fog reports were received from vessels, although fog was observed on 8 days at the 1 p. m. observation at stations on the British Isles.

TABLE 1.—Solar radiation intensities during January, 1922—Contd.

Lincoln, Nebr.

Sun's zenith distance.													
Date.		8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon.	
		75th meridian time.	Air mass.										Local mean solar time.
			A. M.					P. M.					
			e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	
Jan.	2	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.	
	3	3.15	0.85	1.02	1.12	1.22	1.39	1.22	1.04	0.85	0.60	0.42	
	5	2.87	0.90	1.07	1.17	1.27	1.44	1.27	1.10	0.97	0.85	3.63	
	6	0.79	0.97	1.06	1.22	1.39	1.51	1.22	1.04	0.83	0.71	1.24	
	7	1.45	0.87	1.04	1.14	1.24	1.41	1.24	1.07	0.91	0.79	3.00	
	9	2.49	0.74	0.86	1.03	1.16	1.39	1.16	0.97	0.83	0.71	3.63	
	22	3.15	0.59	0.89	1.07	1.24	1.41	1.24	1.07	0.91	0.79	3.63	
	24	0.74	0.84	1.00	1.15	1.39	1.51	1.15	0.96	0.83	0.71	1.07	
	27	0.96	0.84	1.01	1.01	1.16	1.41	1.16	0.96	0.83	0.71	1.78	
Means		3.15	0.80	0.95	1.06	1.14	1.24	1.14	0.96	0.83	0.71	3.30	
Departures			-0.11	-0.08	-0.10	-0.20		-0.04	-0.13	-0.20	-0.25		

Santa Fe, N. Mex.

Jan. 10.....	2.02	1.34	1.55	1.50	1.38	1.24	1.28	3.15
11.....	2.10	1.36	1.48	1.50	1.38	1.24	1.28	2.16
12.....	1.68	1.31	1.55	1.50	1.38	1.24	1.28	1.68
13.....	1.60	1.34	1.51	1.50	1.38	1.24	1.28	2.30
21.....	1.32	1.34	1.52	1.50	1.38	1.24	1.28	1.68
Means.....		1.34	1.52	(1.50)	(1.41)	1.28	1.23	
Departures.....		-0.04	+0.01	+0.02	+0.06	+0.05	+0.21	

• Extrapolated.

TABLE 2.—Solar and sky radiation received on a horizontal surface.

Week beginning.	Average daily radiation.			Average daily departure for the week.			Excess or deficiency since first of year.		
	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.
Jan. 1.....	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
8.....	167	134	175	+ 8	-11	+	+ 53	- 76	
15.....	184	175	207	+18	+20	+	+182	+ 62	
22.....	102	207	215	-73	+37	+	-331	+324	
29.....	191	215		+ 2	+26	+	-318	+504	

MEASUREMENTS OF THE SOLAR CONSTANT OR RADIATION AT CALMA, CHILE.

By C. G. ABBOT, Assistant Secretary.

[Smithsonian Institution, Washington.]

NOTE.—Owing to delay in transmission, the data from South America will be included in the next issue of the REVIEW.—EDITOR.

January is normally the stormiest month of the year, and, taking it as a whole, the month under discussion lived up to its reputation, although the number of days on which winds of gale force were reported varied considerably in different sections of the ocean when compared to the normal as shown on the Pilot Chart.

On the 1st a HIGH with a crest of over 30.5 inches was over Kansas and strong northerly winds accompanied by comparatively high barometric readings prevailed in the western part of the Gulf of Mexico, as shown by following storm log:

American S. S. Virginia:

Gale began on the 1st, wind N. Lowest barometer 30.14 inches on the 1st, wind N., in latitude 24° 44' N., longitude 96° 06' W. End on the 1st, wind N. Highest force of wind 9, N.; shifts NNE-N.

On the same day there was also a well-developed low over Nova Scotia, and, while at Greenwich mean noon of that day, light to moderate winds were the rule along the American coast, they increased in force later in the day, and by the morning of the 2d, that locality was swept by strong gales, the storm area extending as far east as the 60th meridian, between the 30th and 40th parallels. Storm logs follow:

American S. S. *El Mundo*:

January 1, fresh WNW. wind with barometer falling fast, overcast sky, rough sea; 7 p. m. position, 33° 32' N., 76° 30' W.

January 2, fresh NNW. gale, heavy swell from N., wind moderated during day; 7 p. m. position 36° 52' N., 75° 33' W.

American S. S. *Carrillo*:

January 1, strong winds with heavy rain squalls, wind veering from SW. to NW. Barometer fell to 29.7 inches at 4 p. m. Rough confused sea. 7 p. m. position, 33° N., 74° 07' W.

January 2, moderate to fresh gales, rough sea, barometer unsteady. heavy snow squalls in a. m.; 7 p. m. position 34° 20' N., 74° 33' W.

British S. S. *Gloria de Larrinaga*:

Gale began on the 1st. Lowest barometer 29.15 inches at 2 p. m.; on the 2d, wind S., 10, in latitude 37° 32' N., longitude 60° 20' W. End on the 4th, wind NW. Highest force of wind, 10; shifts W.-NW.-W.

From the 2d to the 4th there was a disturbance of limited extent over the British Isles, as shown by following storm log from the American S. S. *Glenpool*:

Gale began on the 2d, wind WNW. Lowest barometer 29.15 inches at 4 a. m. on the 2d, wind WNW., 7, in latitude 58° 18' N., 0° 40' W. End on the 4th, wind N. Highest force of wind, 9; shifts NNE.-WNW.-NW.

The western disturbance moved slowly northeastward during the next 24 hours, and on the 3d was central near Sydney, Nova Scotia, the storm area now covering the region between the 30th and 45th parallels, and the 58th and 68th meridians. Southerly gales were also encountered by a few vessels near the 45th meridian, as shown by storm log from American S. S. *Noccalua*:

Gale began on the 3d. Lowest barometer 29.83 inches at 4 a. m. on the 4th, wind SSE., 8, in latitude 39° 40' N., longitude 44° 50' W. End on the 4th, SW. Highest force of wind 8, SSE.; steady from SSE.

From the 4th to the 6th moderate weather prevailed over the entire ocean, except that on the latter date there was a low of limited extent near latitude 55° N., longitude 25° W. The easterly drift of this depression was slow, and moderate to strong gales prevailed until the 11th over the region between 30th meridian and the European coast. Storm logs follow:

American S. S. *Glenpool*:

Gale began on the 6th, wind SSW. Lowest barometer 28.67 inches at 2:30 a. m. on the 7th, wind SW., 8, in latitude 56° 10' N., longitude 23° 48' W. End on the 8th, wind WSW. Highest force of wind 8, WSW.; shifts SW.-WSW.-WNW.-WSW.

Danish S. S. *Arkansas*:

Gale began on the 8th, wind WSW. Lowest barometer 29.60 inches at 7 a. m. on the 8th, wind SW., in latitude 47° 57' N., longitude 24° 30' W. End on the 9th, wind NW. Highest force of wind 10, SW.; shifts SSW.-NW.

Danish S. S. *Frederick VIII*:

Gale began on the 9th, wind WSW. Lowest barometer 29.50 inches at 2 a. m. on the 11th, wind W., in latitude 57° N., longitude 21° 30' W. End of gale on the 11th, wind NW. Highest force of wind 10; shifts WSW.-W.-NW.

On the 9th, Father Point, Quebec, was near the center of a low, and only moderate winds were reported at Greenwich mean noon by vessels between the 50th meridian and the American coast. Later in the day, however, and on the morning of the 10th, gales were encountered over a limited area. Storm logs:

British S. S. *Vasconia*:

Gale began on the 9th, wind S. Lowest barometer 29.10 inches at 11 p. m. on the 9th, wind S., 11, in latitude 42° 08' N., longitude 56° 13' W. End on the 10th, wind W. Highest force of wind 11, S.; shifts SSW.-SW.

British S. S. *Burgondier*:

Gale began on the 9th, wind S. Lowest barometer 29.60 inches at 8 p. m. on the 9th in latitude 41° N., longitude 55° 30' W. End on the 10th, wind NW. Highest force of wind 10, SW.; shifts S.-SW.

On the 11th there was a well defined low central near Norfolk, Va., accompanied by strong gales along the coast between Hatteras and Charleston. This disturbance moved in a north-northeasterly direction, and on the 12th the center was near Father Point, Quebec; it then curved sharply toward the east, being central near St. Johns, N. F., on the 13th, and on that date southerly gales were encountered over a limited area between the 45th and 50th parallels and the 40th and 45th meridians. Storm logs follow:

American S. S. *Cody*:

Gale began on the 11th, wind SE. Lowest barometer 29.04 inches at 1 p. m. on the 11th, wind SW., in latitude 36° 05' N., longitude 73° 10' W. End on the 12th, wind NW. Highest force of wind 11; shifts SE.-NW.

Belgian S. S. *Sunoco*:

Gale began on the 13th, wind S. Lowest barometer 29.78 inches at 7 p. m. on the 13th, wind SW., 9, in latitude 48° 25' N., longitude 43° W. End on the 13th, wind W. Highest force of wind 10; shifts S.-SW.

From the 15th to the 17th moderate winds were the rule over the western division of the ocean, while east of the 40th meridian heavy weather prevailed. Storm logs follow:

American S. S. *Finland*:

Gale began on the 15th. Lowest barometer 29.78 inches at 8 p. m. on the 15th, wind WNW., 8, in latitude 49° 36' N., longitude 12° 40' W. End on the 16th, wind NNW. Highest force of wind 9; hauled gradually to N.

Swedish S. S. *Stockholm*:

Gale began on the 15th, wind W. Lowest barometer 28.96 inches at 4 a. m. on the 16th, wind W., in latitude 58° 10' N., longitude 20° 40' W. End on the 17th, wind WSW. Highest force of wind 9; shifts WSW.-SW.-SSW.

French S. S. *La Lorraine*:

Gale began on the 16th, wind WSW. Lowest barometer 28.95 inches on the 19th, wind W., 9, in latitude 43° 20' N., longitude 38° 20' W. End on the 20th, wind N. Highest force of wind 12; shifts SW.-N.

Charts IX to XVI show the conditions from January 18 to 25, both inclusive. This was period of exceptionally heavy weather, and on several days storm areas covered the greater part of the ocean. It was during this period that the Norwegian steamer *Mod* was lost, and a large number of other casualties were also reported. Storm logs follow:

British S. S. *Valemor*:

Gale began on the 18th, wind S., 10. Lowest barometer 29.35 inches at 4 p. m. on the 18th, wind SW., 12, in latitude 39° 40' N., longitude 64° W. End on the 19th, wind NW. Highest force of wind 12, SW.; shifts SW.-W.

Italian S. S. *Milazzo*:

Gale began on the 19th, wind SW. Lowest barometer 28.79 inches at 6 a. m. on the 19th, in latitude 41° 04' N., longitude 43° 40' W. End on the 19th, wind NW. Highest force of wind 11; shifts SW.-W.-NW.

British S. S. *Badagry*:

Gale began on the 19th, wind SW. Lowest barometer 28.94 inches at 4 a. m. on the 21st, wind SW., 11, in latitude 41° N., longitude 35° W. End on the 22d, wind NW. Highest force of wind 12; shifts SW.-NW.

American S. S. *Cliffwood*:

Gale began on the 19th, wind NW. Lowest barometer 29.27 inches at 5 p. m. on the 20th, wind SW., 8, in latitude 45° 10' N., longitude 19° W. End on the 21st, wind W. Highest force of wind 10; shifts SW.-WNW.

Dutch S. S. *Eemdijk*:

Gale began on the 19th, wind SW., 6. Lowest barometer 28.96 inches on the 21st, wind W., 7, in latitude 46° 38' N., longitude 20° 37' W. End on the 22d, wind SSE., 7. Highest force of wind 11, SW.; shifts SW.-NW.

British S. S. *Bradford City*:

Gale began on the 21st, wind NNW. Lowest barometer 28.07 inches on the 21st at 3 p. m., wind NNW., 11, in latitude $48^{\circ} 52' N.$, longitude $86^{\circ} 51' W.$ End on the 22d, wind NNW. Highest force of wind 12; shifts NNW.-NE.-N.-NW. This gale was of force 11 throughout with squalls of hurricane force. The Norwegian steamer *Mod* foundered on the 22d near latitude $46^{\circ} 17' N.$, longitude $41^{\circ} 10' W.$

Danish S. S. *Texas*:

Gale began on the 21st, wind SSW. Lowest barometer 28.79 inches at 6 p. m. on the 22d, wind S., in latitude $58^{\circ} N.$, longitude $20^{\circ} 05' W.$ End on the 23d, wind SSW. Highest force of wind 12; shifts not given.

French S. S. *La Lorraine*:

Gale began on the 23d, wind WSW. Lowest barometer 29.71 inches on the 23d, wind W., 7, in latitude $42^{\circ} 30' N.$, longitude $60^{\circ} 17' W.$ End on the 24th wind NW. Highest force of wind 10; shifts W.-WNW.

Dutch S. S. *Rotterdam*:

Gale began on the 23d, wind WNW. Lowest barometer 28.96 inches at 4 p. m. on the 23d, wind NNW., 10, in latitude $45^{\circ} 04' N.$, longitude $44^{\circ} 57' W.$ End on the 27th, wind W. Highest force of wind 11; shifts WNW.-NW.

American S. S. *Montana*:

Gale began on the 23d. Lowest barometer 28.20 inches at 4 p. m. on the 24th, wind SW., 8, in latitude $48^{\circ} 11' N.$, longitude $34^{\circ} 58' W.$ End on the 26th, wind WSW. Highest force of wind 11, SW.; shifts not given.

British S. S. *Lapland*:

Gale began on the 24th, wind SE. Lowest barometer 28.26 inches at 1 a. m. on the 25th, wind W., 10, in latitude $48^{\circ} 18' N.$, longitude $33^{\circ} 35' W.$ End on the 25th, wind W. Highest force of wind 12; shifts SW.-W.-WNW.

American S. S. *Cliffwood*:

Gale began on the 24th, wind W. Lowest barometer 29.31 inches at 6 a. m. on the 24th, wind W., 10, in latitude $39^{\circ} 25' N.$, longitude $30^{\circ} 30' W.$ End on the 25th, wind WSW. Highest force of wind 12; shifts SW.-W.

On the 26th strong gales still prevailed over the middle sections of the ocean and northerly winds of gale force were also encountered off the coasts of Georgia and South Carolina. Storm logs:

American S. S. *West Nilus*:

25th moderate wind shifts from W. by N. to W. by S., force 3 to 7. Weather moderating, sea confused, rough and heavy. Westerly swell, barometer falling slowly from 29.19 to 28.79 inches. Greenwich mean moon position on the 26th, latitude $47^{\circ} N.$, longitude $33^{\circ} W.$

American S. S. *William G. Warden*:

Gale began on the 26th, wind NE. Lowest barometer 29.52 inches on the 29th, wind NW., in latitude $30^{\circ} 51' N.$, longitude $79^{\circ} 20' W.$ End on the 30th, wind N. Highest force of wind 10, shifted three points.

By the 27th the disturbance that was near mid-ocean on the 26th, had moved eastward, the storm area having contracted somewhat, and westerly gales were encountered by vessels in the region between the 30th meridian and the European coast. Storm log:

American S. S. *W. H. Tilford*:

Gale began on the 26th, wind W. Lowest barometer 29.41 inches at 10.30 p. m. on the 26th, wind W., in latitude $44^{\circ} 40' N.$, longitude $12^{\circ} 31' W.$ End on the 29th, wind W. Highest force of wind 11, WSW.; shifts SW.W.

On the 28th there was a low central near latitude $47^{\circ} N.$, longitude $40^{\circ} W.$, with northerly gales in the westerly quadrants. Storm log:

British S. S. *Winnebago*:

Gale began on the 27th, wind NNW. Lowest barometer 28.84 inches at 4 p. m. on the 27th, wind WSW., 4, in latitude $48^{\circ} 47' N.$, longitude $45^{\circ} 47' W.$ End on the 29th NNW. Highest force of wind 9, NNW.; shifts S.-WSW.-NNW.

The depression off the American coast, near Hatteras, that was first reported on the 26th, seemed to take on a new lease of life, as on the 29th strong to moderate gales covered a limited area between the 30th and 40th parallels, west of the 68th meridian. This disturbance moved slowly eastward, increasing in extent and intensity, and by the 31st the storm area extended south to the 30th parallel and east to the 45th meridian. Storm logs:

Dutch S. S. *Maashaven*:

Gale began on the 28th, wind W. Lowest barometer 29.52 inches at 4 a. m. on the 29th, wind W., 9, in latitude $33^{\circ} 23' N.$, longitude $70^{\circ} 55' W.$ End on the 30th. Highest force of wind 10; shifts SW.-W.-NNW.

British S. S. *Badagry*:

Gale began on the 29th, wind ESE. Lowest barometer 29.10 inches at 8 p. m. on the 29th, wind E., 11, at latitude $39^{\circ} 20' N.$, longitude $59^{\circ} W.$ End on the 30th, wind N. Highest force of wind 12; shifts ESE.-N.

American S. S. *Cliffwood*:

Gale began on the 30th, wind SW. Lowest barometer 29.48 inches at 2 p. m. on the 31st, wind SW., 12, in latitude $31^{\circ} 32' N.$, longitude $52^{\circ} W.$ End on the 31st, wind NW. Highest force of wind 12, SW.; shifts SW.-W.

American S. S. *Independence Hall*:

Gale began on the 30th, wind N. Lowest barometer 29.20 inches at noon on the 30th, wind NW., 4, in latitude $35^{\circ} 48' N.$, longitude $56^{\circ} 39' W.$ End on the 31st. Highest force of wind 10, N.; steady NW.

Swedish S. S. *Carlsholm*:

Gale began on 30th, wind NNE. Lowest barometer 28.82 inches at 4 p. m. on the 31st, wind N., 12, in latitude $45^{\circ} 22' N.$, longitude $50^{\circ} 09' W.$ End February 1, wind NNW. Highest force of wind 12, N.; steady NW.

NORTH PACIFIC OCEAN.

By F. G. TINGLEY.

Judging from the reports that have been received from vessels the weather of the month over the North Pacific Ocean did not vary greatly from the average weather of January, differing in this respect from that of the North Atlantic Ocean, which was distinctly stormy. Most of the gales reported occurred west of the 155th meridian, W. longitude—85 per cent of those reported prior to the 26th. During the 26th-28th vessels between the Hawaiian Islands and the American coast experienced unusual northeast gales, due to the building up of a strong anticyclone to the northward.

Two vessels report having experienced winds of hurricane force. These were the American S. S. *West Jena*, Capt. J. A. Jacobson, Observer W. L. Doucett, Manila (Jan. 10), for San Pedro, and the British S. S. *Empress of Asia*, Capt. L. D. Douglas, R. N. R., Yokohama (Jan. 14), for Vancouver. The storm logs of these vessels are as follows:

West Jena.—Gale began on January 18 (eastern time) with wind at ENE. On the 19th the wind hauled slowly to S. and W., the barometer falling steadily. Lowest barometer, 29.41 inches, occurred at 6 a. m. on the 20th when in $35^{\circ} 10' N.$, $149^{\circ} 50' E.$, wind at that time SW. to W. Gale ended on 21st. Highest force, 12, W.

Empress of Asia.—Gale began early on 18th (eastern time) with wind at WNW. Lowest barometer, 29.11 inches, occurred at 4 a. m. same day in $46^{\circ} 48' N.$, $169^{\circ} 14' E.$, wind at the time being WNW., 7. Gale ended at 8 p. m. 18th. Highest force, 12, S. Wind backed from WNW. to S.

The American S. S. *Mawi*, Capt. Peter Johnson, Honolulu (Jan. 26) for San Francisco, had very heavy weather for four of the five and one-half days of her voyage. For